

# Best-in-class data, combined with machine learning, provides revolutionary insight into chronic disease management

*Rich claims data from Blue Health Intelligence® (BHI®) made it possible for Decode Health to create comprehensive models that detect patients with undiagnosed or misdiagnosed disease and predict individuals who will likely experience the highest healthcare spend*



## Background

Decode Health, a Nashville-based analytics company, developed a machine learning (ML) engine that uncovers specific patterns of chronic disease risk. Decode initially focused on inflammatory autoimmune diseases, which are difficult to diagnose and cost the healthcare system approximately \$90 billion a year.<sup>1</sup> Misdiagnosis of these diseases is not uncommon and can lead to serious adverse events and hospitalization.

## Challenge: Machine Learning Needs Good Data

Decode wanted to test the theory that its ML engine could be applied to large, population-level data sets to construct predictive models for multiple chronic diseases. Decode needed a comprehensive, multi-year, longitudinal data source that captured a wide range of patient populations across different geographies. They hoped to use the data to train their ML to capture subtle differences and patterns occurring in patients diagnosed and treated for autoimmune disease over time.

“Despite significant advancements in laboratory medicine and diagnostic criteria, clinicians still don’t have all the tools they need to diagnose patients early and monitor patients proactively, particularly in the context of inflammatory diseases,” said Chase Spurlock, PhD, CEO of Decode Health. “To build our technology, we needed a full population view and data that covered every demographic segment and episode of care.”

## Identifying Undetected and Misdiagnosed Disease

With access to the nation’s largest longitudinal claims database with continuous member enrollment, BHI

delivered the robust data set that Decode needed to verify its theory. Decode worked with BHI to develop a custom claims data set that included three years of continuous claims data from 2 million people located in a specific region where autoimmune conditions like MS and Crohn’s disease were most prevalent. Decode data scientists used this foundational data to create robust predictive models that identified patients with undetected or misdiagnosed disease in six major inflammatory autoimmune disorders and related chronic conditions. Using the entire data set – not just for specific diagnoses, but for the full population – Decode’s ML technology detected disease patterns specific to each targeted disease.

“This method allowed us to take a pure, discovery-based approach for identifying and tracking patterns of disease,” Spurlock said. “Our machine learning approach can uncover novel clinical correlations and disease trends that haven’t been discovered previously.”

## Early Detection and Treatment = Cost Savings

Using a portion of the BHI data, Decode trained and tested a series of disease-prediction models to identify patients who had not received a conventional autoimmune diagnosis, but who were predicted to develop autoimmune diseases in the future. The company further evaluated the data to see if clinicians documented autoimmune diagnoses and treatments. Using Crohn’s disease as an example, the cost profile for patients who received a delayed diagnosis two years after Decode’s prediction was two times higher, on average, than the cost profile for patients who were diagnosed within one year of Decode’s prediction. The results of this study confirmed their premise. Early diagnosis and early treatment of autoimmune diseases leads to reduced spend over time.

“We wanted a data set that allowed us to capture a wide range of patient populations. BHI’s National Data Repository allowed us to architect a platform with unique classifiers that captured subtle clinical and geographic nuances. The BHI data set also gave us a comprehensive R&D playground to look at the different diseases we were addressing.”

**CHASE SPURLOCK, PhD, CEO OF DECODE**



#### **Decode needed comprehensive big data**

To test its ML platform, Decode needed claims data covering every demographic segment and episode of care for autoimmune disease



#### **BHI was Decode’s preferred choice**

BHI provided three years of continuous claims data from 2 million unique individuals located in a specific region where autoimmune disease was most prevalent



#### **Big data enhanced Decode’s capabilities**

BHI’s data allowed Decode’s ML to increase the accuracy and efficiency of their autoimmune disease predictions for select groups of patients



#### **Early detection improved outcomes and costs**

Decode was able to prove that early diagnosis and treatment of autoimmune diseases leads to reduced spend over time

In addition to identifying undetected or misdiagnosed disease, Decode used BHI’s data to predict patients who were heading towards an adverse event or periods of increased healthcare utilization months in advance of when those things actually occurred.

“Adverse events – or disease complications – are common, particularly in autoimmune diseases like MS or Crohn’s,” Spurlock said. “By mining BHI’s data, we identified specific patterns for MS and Crohn’s that were indicators of future clinical events and periods of higher or lower future healthcare utilization. Being able to track specific patients who exhibit patterns of rising, future disease risk is a significant breakthrough. Care teams can use this information to proactively engage with patients, improving clinical outcomes and reducing unnecessary healthcare expense. Even better yet, our process is extensible to many chronic diseases.”

Decode also proved the ability of their ML to identify and monitor patients with uncontrolled disease by using BHI’s data to perform detailed studies of patients with established disease diagnoses. For example, Decode used two years of BHI’s historical claims data to build a model predicting healthcare utilization for a prospective four-month period in a single disease state. During this future period, the most costly 200 Crohn’s disease and MS patients accounted for total direct costs of \$9.2 million. Decode’s ML correctly identified a subset of these top 200 patients whose treatment costs made up 90% of the total cost profile. Decode’s approach outperformed traditional, historical spending analyses by upwards of 30%, resulting in additional cost savings opportunities.

Decode has also used its framework to analyze customer claims data sets. For example, Decode’s ML successfully predicted shifting risk profiles that accounted for more than 70% of the total healthcare expense for Crohn’s and MS patients over a three-year period. The majority of these potentially unnecessary costs were related to emergency department visits and biologic-driven interventions.

### **Applying More Data for Better Outcomes**

Beyond claims data, Decode enriches its models with information from partners and customers to impute social determinants of health (SDoH). Incorporating SDoH information enhances Decode’s chronic disease prediction models and helps design programs to better control for member outcomes. It is now appreciated that more than 80% of patient outcomes are strongly determined by SDoH factors.<sup>ii</sup>

“Knowing that BHI also has experience augmenting claims data with SDoH information unlocks additional possibilities for future collaboration, and could further advance our collective goal of producing new tools and analytics that enable care teams to deliver better patient outcomes,” Spurlock said.

Uncovering insights from claims data has become an essential practice for healthcare organizations seeking new and improved perspectives on patient care and population health. When technology like Decode Health’s ML is combined with the big data available from BHI, the predictive power of data analytics to improve healthcare becomes hard to deny.

<sup>i</sup>Lukasz Wylezinski, et al. “Illuminating an Invisible Epidemic: A Systemic Review of the Clinical and Economic Benefits of Early Diagnosis and Treatment in Inflammatory Disease and Related Syndromes.” *Journal of Clinical Medicine*. April 11, 2019.

<sup>ii</sup>Mark Fuchs, “Social Determinants of Health (SDoH)... or maybe, Socially Dominating Our Health Information.” *Health Language Blog*. November 14, 2019. <https://blog.healthlanguage.com/sdoh>